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Western Burrowing Owls in California Produce Second Broods of Chicks

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ABSTRACT.—We present the first evidence that western Burrowing Owls are capable of raising a second brood of chicks within a nesting season once their first brood successfully fledges. Two pairs of owls in central California known to have successfully fledged chicks from a first brood renested in 1998, with one pair producing five additional fledglings. *Received 29 March 1999, accepted 15 July 1999.*

Western Burrowing Owls (*Athene cunicularia*) are thought to be declining throughout much of their range (DeSante et al. 1997, James and Espie 1997). The potential causes of these declines vary with location, but likely include large-scale habitat destruction from farming or development, reductions in species such as ground squirrels that create the burrows that the owls use, and agricultural chemicals (James and Espie 1997, Gervais et al. in press). Because of the perceived threat to the viability of Burrowing Owl populations, the species has been listed as endangered, threatened, or of special management concern in a number of North American states and provinces (Haug et al. 1993).

Effective conservation at the species level requires understanding the population dynamics of the species in question, which in turn means accurate estimation of demographic parameters such as survival and reproductive rates. These can be used in simplified models that allow the examination of the effects of possible management actions or environmental perturbations on population persistence. Such an approach has recently been used for the northern Spotted Owl (*Strix occidentalis*; Noon and Biles 1990), and for predicting the effects of pesticide exposure on wildlife populations (Caswell 1996, Calow et al. 1997).

Simulations of generalized life history strategies have shown that for a species with relatively low adult survivorship and a short life span, reproductive success may be most influential in maintaining population viability (Emlen and Pikitch 1989). This is likely to be generally true for Burrowing Owls. They are capable of producing up to 12 eggs in a clutch (Haug et al. 1993), and we have observed up to 10 young fledged per nest in good reproductive years. In addition, Burrowing Owl annual adult survivorship appears to be quite low, with between-year return rates ranging from 33–58% (Haug et al. 1993), and a longevity record for a wild banded owl of 8 years and 8 months (Kennard 1975). If sensitivity analyses prove that the Burrowing Owl fits the predictions of the Emlen-Pikitch model (Emlen and Pikitch 1989) for a small, relatively short-lived species, then accurate assessment of reproductive potential of Burrowing Owls is essential to evaluating population processes.

Only Florida Burrowing Owls have been known to produce second broods within a season (Millsap and Bear 1990). We report two

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instances of western Burrowing Owl pairs attempting second broods after the first brood had successfully been fledged during the 1998 breeding season. To our knowledge, this is the first time the production of more than a single brood per season has been verified in western Burrowing Owls.

METHODS AND RESULTS

We have conducted demographic research since 1997 on a population of Burrowing Owls at Naval Air Station Lemoore (36° 20′ N, 119° 57′ W), 50 km southwest of Fresno, Californa. The naval air station supports approximately 65 breeding pairs of owls, which appear to be winter residents (Gervais and Rosenberg, unpubl. data). Nesting habitat on the station is primarily small patches of exotic annual grasses along runway easements and in wildlife areas surrounded by agricultural fields. Wildlife areas are fallow fields that are composed of exotic annual grasses and weeds, although they are burned annually. Approximately 75% of the adult resident population of owls is now banded with U.S. Fish and Wildlife Service bands and unique alpha-numeric rivet bands (Acraft Bird Bands, Edmonton, Alberta, Canada).

Early in the season, we collected eggs for use in an ongoing toxicology study (Gervais et al. in press). One sampled burrow contained at least four eggs and the incubating female on 19 April 1998. At that time, we identified the female from her bands and we removed one egg. Her mate also was previously banded and was identified by resighting his bands early in the nesting season. This nest successfully fledged two chicks in early June. We recaptured the female owl on 14 June using a mouse baited spring net. At capture, she weighed 198 g, well above the 150 g average for this species (Haug et al. 1993), and was noticeably swollen in the lower abdomen. Her brood patch was well developed and vascularized, suggesting nesting activity.

To verify that this female was indeed relaying, we used an infrared burrow probe (Christensen Designs, Manteca, California) to examine the burrow on 16 June. We observed the two fledged chicks in the entrance to the nesting chamber, but were unable to see beyond them. The burrow entrance had fresh decorations of coyote dung and the nest tunnel was lined with similar debris. The adults were observed at the burrow entrance throughout the next few weeks; individual identity was confirmed using their color bands.

We examined the nest again on 27 June, and observed four eggs in the nest chamber after the female flushed from the burrow entrance. We removed two eggs through an access hole originally dug for the toxicological study egg sampling (Gervais et al., in press). The eggs were cool, but the shells were very clean and candling revealed clear egg contents with no visible development. The eggs were returned to the nest after inspection and the access holes covered again with dirt and boards. We do not believe these eggs were from the previous nesting attempt because of their clear contents and clean shells. Eggs that sit in the burrow for eight weeks would have dark contents as they began to rot and shells would be covered with dirt and fecal matter from the chicks.

When we examined the burrow on 14 July, the eggs were gone. No owls were present at the burrow during that visit, although both adults continued to be sighted in the area through July.

A second double nesting attempt also occurred in 1998. We observed with the infrared burrow probe a banded female owl in her burrow with nine eggs on 16 April; she raised one chick to fledging after the disappearance of her mate. We observed this same female at the same burrow entrance in early September with five buffy breasted chicks. These chicks clearly had recently emerged from their burrows, because juvenile owls fledged during the main breeding attempt at this site have typically undergone a body molt by this time and their breasts are heavily streaked in the manner of adult birds. No other nests within the area still contained chicks at this time. The five chicks were frequently seen at the burrow entrance through the middle of September when fieldwork was discontinued. This is typical of young owls still fully dependent on their parents for food; owls fledged earlier in the season had dispersed from their natal burrows by early August as indicated by radio telemetry (Gervais and Rosenberg, unpubl. data). The owl's mate for this second attempt was also banded, but his bands were consistently too muddy to read and he was never identified.

Our fieldwork did not include detailed observations of all nests in our study area throughout the summer and early fall, but we did not find any other evidence in support of double brooding attempts. These attempts may be quite rare and only occur in exceptional years. The 1998 breeding season was marked by very late rains, resulting in a high proportion of renesting efforts by the owls (Rosenberg and Gervais, unpubl. data). The prolonged growing season that followed the wet spring may have led to conditions conducive to late-season breeding attempts, such as greater food availability.

Nevertheless, it is clear that at least in some conditions western Burrowing Owls can raise two broods of chicks, thus increasing their reproductive output. This may be important for individuals whose first broods were small because of predation or the loss of a mate, or for populations recovering from environmental damage such as pesticides or burrowing rodent control. This information is also important for use in sensitivity modeling such as that done by Emlen and Pikitch (1989) or Noon and Biles (1990), because accurate demographic parameter estimation is essential to determining life history strategies and evaluating demographic risks to populations.

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LITERATURE CITED

CALOW, P., M. SIBLEY, AND V. FORBES. 1997. Risk assessment on the basis of simplified life-history scenarios. Environ. Toxicol. Chem. 16:1983–1989.

CASWELL, H. 1996. Demography meets ecotoxicology: untangling the population level effects of toxic substances. Pp. 255–288 *in* Ecotoxicology: a hierarchical approach (M. C. Newman and C. H. Jagoe, Eds.). Lewis Publishers, Boca Raton, Florida.

DESANTE, D. F., E. D. RUHLEN, S. L. ADAMANY, K. M. BURTON, AND S. AMIN. 1997. A census of Burrowing Owls in central California in 1991. Pp. 38–48 *in* The Burrowing Owl: its biology and management (J. L. Lincer and K. Steenhof, Eds.). Raptor Research Foundation, Inc., Boise, Idaho.

EMLEN, J. M. AND E. K. PIKITCH. 1989. Animal population dynamics: identification of critical components. Ecol. Model. 44:253–273.

GERVAIS, J. A., D. K. ROSENBERG, D. M. FRY, L. TRULIO, AND K. K. STURM. In press. Burrowing Owls and agricultural pesticides: evaluation of residues and risks for three populations in California. Environ. Toxicol. Chem.

HAUG, E. A., B. A. MILLSAP, AND M. S. MARTELL. 1993. Burrowing Owl (*Speotyto cunicularia*). *In* The birds of North America, no. 61 (A. Poole and F. Gill, Eds.). The Academy of Natural Sciences, Philadelphia, Pennsylvania; The American Ornithologists' Union, Washington, D.C.

JAMES, P. C. AND R. H. M. ESPIE. 1997. Current status of the Burrowing Owl in North America: an agency survey. Pp. 3–5 *in* The Burrowing Owl: its biology and management (J. L. Lincer and K. Steenhof, Eds.). Raptor Research Foundation, Inc., Boise, Idaho.

KENNARD, J. H. 1975. Longevity records of North American birds. Bird-Banding 46:55–73.

MILLSAP, B. A. AND C. BEAR. 1990. Double brooding by Florida Burrowing Owls. Wilson Bull. 102: 313–317.

NOON, B. R. AND C. BILES. 1990. Mathematical demography of Spotted Owls in the Pacific Northwest. J. Wildl. Manage. 54:18–27.